

Reading: Werner 09: Risk Classification
Model: Univariate Methods for Rating Variable Differentials
Problem Type: Pure Premium Method - With Credibility & Off-Balance

W-09 (022) - (Problem 1)

Find Calculate the indicated rate change for each class that results in a revenue-neutral overall change.

Given

level of variable	EE	reported L + ALAE	current relativity
1	171	107,730	1.460
2	418	171,380	1.000
3	210	128,100	0.700

* EE = Earned Exposures

Full credibility: 9,370 exposures

Use the square-root rule for credibility.

Complement of credibility is no change.

Step 1 complete the following table and note the key columns:

(Col 5) = indicated relativity

(Col 8) = current relativity (**normalized** so that the exposure-weighted average equals 1.000)

(Col 9) = weighted average of (Col 5) and (Col 8) using (Col 6) as the weight for (Col 5)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
level of variable	EE	reported L + ALAE	pure premium	indicated relativity	credibility (weights)	current relativity	normalized current relativity	cred-wtd indicated relativity
A	171	107,730	630	1.236	0.135	1.46	1.432	1.405
B	418	171,380	410	0.804	0.211	1.00	0.981	0.944
C	210	128,100	610	1.197	0.150	0.70	0.687	0.763
Total	799	407,210	509.650	1.000	--	1.020	1.000	0.995

(4) = (3) / (2)

(5) = (4) / (Tot4)

(6) = $\sqrt[4]{(2) / 9370}$ (maximum value is 1.0)

(7) given information

(Tot7) = exposure-weighted average of (6)

(8) = (7) / (Tot7)

(9) = $[(6) \times (5) + (1.0 - (6)) \times (8)]$

Step 2 calculate the % change in relativity from current to credibility-weighted indicated, but note:

==> you must first normalize the cred-wtd indicated relativity as shown in (Col 10)

==> you must then "**off-balance**" the change in (Col 11) so that the **total change is 0.0%** in (Col 12)

(1)	(10)	(11)	(12)	(12) = (10)/(8) <== alternate formula for (12)
level of variable	normalized cred-wtd ind. rel.	change	change with off-bal.	change with off-bal.
A	1.413	-3.2%	-1.3%	-1.3%
B	0.948	-5.2%	-3.3%	-3.3%
C	0.767	9.5%	11.7%	11.7%
Total	1.000	-1.9%	0.0%	0.0%

* This way of calculating column (12) seems simpler than the method given in the examiner's report.

(final answers in green)

(10) = (9) / (Tot9)

(11) = (10) / (7) - 1.0

(12) = $(1.0 + (11)) / (1.0 + (Tot11)) - 1.0$

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W-09 (022) - (Problem 2)

Find Calculate the indicated rate change for each class that results in a revenue-neutral overall change.

Given

level of variable	EE	reported L + ALAE	current relativity
1	108	50,760	1.000
2	443	345,540	1.280
3	226	81,360	0.500

* EE = Earned Exposures

Full credibility: 10,580 exposures

Use the square-root rule for credibility.

Complement of credibility is no change.

Step 1 complete the following table and note the key columns:

(Col 5) = indicated relativity

(Col 8) = current relativity (**normalized** so that the exposure-weighted average equals 1.000)

(Col 9) = weighted average of (Col 5) and (Col 8) using (Col 6) as the weight for (Col 5)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
level of variable	reported EE	L + ALAE	pure premium	indicated relativity	credibility (weights)	current relativity	normalized current relativity	cred-wtd indicated relativity
A	108	50,760	470	0.765	0.101	1.00	0.986	0.964
B	443	345,540	780	1.269	0.205	1.28	1.262	1.263
C	226	81,360	360	0.586	0.146	0.50	0.493	0.507
Total	777	477,660	614.749	1.000	--	1.014	1.000	1.002

(4) = (3) / (2)

(5) = (4) / (Tot4)

(6) = $\sqrt[4]{(2) / 10580}$ (maximum value is 1.0)

(7) given information

(Tot7) = exposure-weighted average of (6)

(8) = (7) / (Tot7)

(9) = $[(6) \times (5) + (1.0 - (6)) \times (8)]$

Step 2 calculate the % change in relativity from current to credibility-weighted indicated, but note:

==> you must first normalize the cred-wtd indicated relativity as shown in (Col 10)

==> you must then "off-balance" the change in (Col 11) so that the **total change is 0.0%** in (Col 12)

(1)	(10)	(11)	(12)	(12) = (10)/(8) <== alternate formula for (12)
level of variable	normalized cred-wtd ind. rel.	change	change with off-bal.	change with off-bal.
A	0.962	-3.8%	-2.4%	-2.4%
B	1.261	-1.5%	-0.1%	-0.1%
C	0.506	1.1%	2.6%	2.6%
Total	1.000	-1.4%	0.0%	0.0%

* This way of calculating column (12) seems simpler than the method given in the examiner's report.

(final answers in green)

(10) = (9) / (Tot9)

(11) = (10) / (7) - 1.0

(12) = $(1.0 + (11)) / (1.0 + (Tot11)) - 1.0$